CLAIMS

1.Molecule or polypeptide composition, characterized by the presence in its structure of one or more peptide sequences bearing all or part of one or more T epitope(s) and, optionally, other epitopes, in particulr B epitopes, characteristic of the proteins resulting from the infectious activity of P. falciparum in the hepatic cells

2. Molecule or polypeptide composition according to Claim 1, containing at least one peptide sequence bearing all or part of one or more epitopes characteristic of a protein produced in the hepatocytes infected by P. falciparum and more particularly bearing all or part of one or more T epitope(s) of the proteins produced at the hepatic stage of P. falciparum, characterized in that this peptide sequence is represented by all or part of the amino acid sequence shown in Figure 9 or Figure 10, and which corresponds to the 3' end of the LSA gene.

3. Molecule or polypeptide composition according to Claim 1 or Claim 2, containing at least one peptide sequence bearing all or part of one or more epitope(s) characteristic of a protein produced in the hepatocytes infected by P. falciparum, and more particularly bearing all or part of one or more T epitope(s) of the proteins produced at the hepatic stage of P. falciparum, characterized in that this peptide sequence is represented by all or part of the following amino acid sequence :

RKADTKKNLERKKEHGDILAEDLYGRLEIP
AIELPSENERGYYIPHQSSLPQDNRGNSRD
SKEISIIEKTNRESITTNVEGRRDIHKGHL
EEKKDGSIKPEQKEDKS

this amino acid sequence being optionally preceded by all or part of one or more of the sequences of 17 amino acids of formula :

X_1DLEQX_2RX_3AKEKLQX_4QQ
QX_1DLEQX_2RX_3AKEKLQX_4Q
QQX_1DLEQX_2RX_3AKEKLQX_4
X_4QQX_1DLEQX_2RX_3AKEKLQ
QX_4QQX_1DLEQX_2RX_3AKEKL

$LQX_4QQX_1DLEQX_2RX_3AKEK$

$KLQX_4QQX_1DLEQX_2RX_3AKE$

$EKLQX_4QQX_1DLEQX_2RX_3AK$

$KEKLQX_4QQX_1DLEQX_2RX_3A$

$AKEKLQX_4QQX_1DLEQX_2RX_3$

$X_3AKEKLQX_4QQX_1DLEQX_2R$

$RX_3AKEKLQX_4QQX_1DLEQX_2$

$X_2RX_3AKEKLQX_4QQX_1DLEQ$

$QX_2RX_3AKEKLQX_4QQX_1DLE$

$EQX_2RX_3AKEKLQX_4QQX_1DL$

$LEQX_2RX_3AKEKLQX_4QQX_1D$

$DLEQX_2RX_3AKEKLQX_4QQX_1$

in which :

- ° X_1 is "Ser" or "Arg",
- ° X_2 is "Glu" or "Asp"
- °X_3 is "Arg" or "Leu"
- °X_4 is "Glu" or "Gly"

4. Molecule according to one of the Claims 1 to 3, characterized by all or part of the following amino acid sequence :

LQEQQRDLEQRKADTKKNLERKKEHGDILAEDLYGRLEIP
AIELPSENERGYYIPHQSSLPQDNRGNSRDSKEISIIEKT
NRESITTNVEGRRDIHKGHLEEKKDGSIKPEQKEDKS

5. Molecule according to Claim 1 or Claim 2, characterized by all or part of the following amino acid sequence :

DTKKNLERKKEHGDILAEDLYGRLEIP

6. Molecule according to Claim 1 or Claim 2, characterized by all or part of the following amino acid sequence :

ERRAKEKLQEQQRDLEQRKADTKK

7. Molecule according to Claim 1 or Claim 2, characterized by all or part of the following amino acid sequence :

NSRDSKEISIIEKTNRESITTNVEGRRDIHK

8. Molecule according to Claim 1 , characterized by all or part of the following amino acid sequence :

RDELFNELLNSVDVNGEVKENILEESQVNDDIFNSLVKSVQQEQQHNVEEKVE
ESVEENDEESVEENVEENVEENDDGSVASSVEESIASSVDESIDSSIEENVAP
TVEEIVAPTVEEIVAPSVVEKCAPSVEESVAPSVEESVAEMLKER

shown in Figure 3 and designated hereafter by the polypeptide 729S

9. Molecule according to Claim 1, characterized by all or part of the following amino acid sequence :

RDELFNELLNSVDVNGEVKENILEESQVNDDIFNSLVKSVQQEQQHN

10. Molecule according to any one of the Claims 1, 8 or 9, characterized in that it corresponds to all or part of one of the following amino acid sequences :

- DELFNELLNSVDVNGEVKENILEESQ,
- LEESQVNDDIFSNSLVKSVQQEQQHNV,
- VEKCAPSVEESVAPSVEESVAEMLKER.

11. Molecule or polypeptide composition containing at least one peptide sequence bearing all or part of one or more epitope(s) characteristic of a protein produced in hepatocytes infected by P. falciparum, and more particularly bearing all or part of one or more T epitope(s) of the proteins produced at the hepatic stage of P. falciparum, characterized in that this peptide sequence is represented by all or part of the amino acid sequence shown in Figure 7, and which corresponds to the 5' end of the LSA gene.

12. Molecule or polypeptide composition according to Claim 1, containing at least one peptide sequence bearing all or part of one or more epitope(s) characteristic of a protein produced in hepatocytes infected by P. falciparum, and more particularly bearing all or part of one or more T epitope(s) of the proteins produced at the hepatic stage of P. falciparum, characterized in that this peptide sequence is represented by all or part of the sequence of the first 153 amino acids shown in Figure 7, this amino acid sequence being optionally followed by all or part of one or more of the sequences of 17 amino acids of formula :

$X_1DLEQX_2RX_3AKEKLQX_4QQ$

$QX_1DLEQX_2RX_3AKEKLQX_4Q$

$QQX_1DLEQX_2RX_3AKEKLQX_4$

$X_4QQX_1DLEQX_2RX_3AKEKLQ$

$QX_4QQX_1DLEQX_2RX_3AKEKL$

$LQX_4QQX_1DLEQX_2RX_3AKEK$

$KLQX_4QQX_1DLEQX_2RX_3AKE$

$EKLQX_4QQX_1DLEQX_2RX_3AK$

$KEKLQX_4QQX_1DLEQX_2RX_3A$

$AKEKLQX_4QQX_1DLEQX_2RX_3$

$X_3AKEKLQX_4QQX_1DLEQX_2R$

$RX_3AKEKLQX_4QQX_1DLEQX_2$

$X_2RX_3AKEKLQX_4QQX_1DLEQ$

$QX_2RX_3AKEKLQX_4QQX_1DLE$

$EQX_2RX_3AKEKLQX_4QQX_1DL$

$LEQX_2RX_3AKEKLQX_4QQX_1D$

$DLEQX_2RX_3AKEKLQX_4QQX_1$

in which :

° X_1 is "Ser" or "Arg",

° X_2 is "Glu" or "Asp"

°X_3 is "Arg" or "Leu"

°X_4 is "Glu" or "Gly"

13. Molecule or polypeptide composition according to Claim 1, containing at least one peptide sequence bearing all or part of one or more epitope(s) characteristic of a protein produced in hepatocytes infected by P. falciparum, and more particularly bearing all or part of one or more T epitope(s) of the proteins produced at the hepatic stage of P. falciparum, characterized in that this peptide sequence includes successively :

- all or part of the sequence of the first 153 amino acids shown in Figure 7,

- optionally, all or part of one or more sequences of 17 amino acids of formula :

$X_1DLEQX_2RX_3AKEKLQX_4QQ$

$QX_1DLEQX_2RX_3AKEKLQX_4Q$

$QQX_1DLEQX_2RX_3AKEKLQX_4$

$X_4QQX_1DLEQX_2RX_3AKEKLQ$

$QX_4QQX_1DLEQX_2RX_3AKEKL$

$LQX_4QQX_1DLEQX_2RX_3AKEK$

$KLQX_4QQX_1DLEQX_2RX_3AKE$

$EKLQX_4QQX_1DLEQX_2RX_3AK$

$KEKLQX_4QQX_1DLEQX_2RX_3A$

$AKEKLQX_4QQX_1DLEQX_2RX_3$

$X_3AKEKLQX_4QQX_1DLEQX_2R$

$RX_3AKEKLQX_4QQX_1DLEQX_2$

$X_2RX_3AKEKLQX_4QQX_1DLEQ$

$QX_2RX_3AKEKLQX_4QQX_1DLE$

$EQX_2RX_3AKEKLQX_4QQX_1DL$

$LEQX_2RX_3AKEKLQX_4QQX_1D$

$DLEQX_2RX_3AKEKLQX_4QQX_1$

in which :

° X_1 is "Ser" or "Arg",

° X_2 is "Glu" or "Asp"

°X_3 is "Arg" or "Leu"

°X_4 is "Glu" or "Gly"

- and all or part of the last 279 amino acids shown in Figure 10.

14. Peptide sequence derived from a molecule according to one of the Claims 1 to 13, this sequence exhibiting modifications by substitution of maximally 40% of the amino acids while conserving the biological activity of the molecule mentioned above, in particular the induction of a response of the T lymphocytes, in particular of the cytotoxic T lymphocytes.

15. Immunogenic composition characterized by the combination of a molecule conforming to any one of the Claims 1 to 14 with a pharmaceutically acceptable vehicle.

16. Composition of vaccine directed against malaria, containing among other immunogenic ingredients, a molecule conforming to any one of the Claims 1 to 14.
17. Nucleotide sequence corresponding according to the universal genetic code to a peptide sequence such as defined in one of the Claims 1 to 14.
18. Monoclonal or polyclonal antibodies which recognize specifically the peptide sequences according to any one of the Claims 1 to 14.
19. In vitro diagnostic method for malaria in an individual likely to be infected by P. falciparum which comprises the placing of a tissue or a biological fluid taken from an individual in contact with a polypeptide composition according to Claims 1 to 14 under conditions allowing an in vitro immunological reaction to occur between the said polypeptide composition and the antibodies possibly present in the biological tissue, and the in vitro detection of the antigen-antibody complexes possibly formed.
20. In vitro diagnostic method for malaria in an individual likely to be infected by P. falciparum which comprises the placing of a tissue or a biological fluid taken from an individual in contact with antibodies according to Claim 18 under conditions allowing an in vitro immunological reaction to occur between the said antibodies and the proteins specific for P. falciparum possibly present in the biological tissue, and the in vitro detection of the antigen-antibody complexes possibly formed.
21. Kit for the in vitro diagnosis of malaria according to Claim 19, characterized in that it contains :
- one or more polypeptide composition(s) according to one of the Claims 1 to 14,
- the reagents for making up a suitable medium for carrying out the immunological reaction,
- the reagents allowing the detection of the antigen-antibody complexes produced as a result of the immunological reaction, these reagents also may bear a label or be capable of being recognized in turn by a labelled reagent, more particularly in the case in which the above-mentioned polypeptide composition is not labelled.
22. Kit for the in vitro diagnosis of malaria according to Claim 20, characterized in that it contains :
- antibodies according to Claim 18,

- the reagents for making up a suitable medium for carrying out the immunological reaction,
- the reagents allowing the detection of the antigen-antibody complexes produced as a result of the immunological reaction, these reagents also may bear a label or be capable of being recognized in turn by a labelled reagent, more particularly in the case in which the above-mentioned polypeptide composition is not labelled.

23. Recombinant vector for the cloning of a nucleotide sequence according to Claim 17, and/or the expression of the polypeptide encoded in the above-mentioned sequence containing a recombinant nucleic acid containing at least one nucleotide sequence according to Claim 17 at one of the sites inessential for its replication, the said vector being in particular of the plasmid, cosmid or phage type and more particularly the plasmid DG536 deposited with the CNCM under the number I-1027 on 17 January 1991, as well as the plasmid DG729S deposited with the CNCM under the number I-1028 on 17 January 1991.

24. Pharmaceutical composition containing as active substance one or more monoclonal or polyclonal antibodies according to Claim 18, in combination with a pharmaceutically acceptable vehicle.

25. Use of a molecule according to any one of the Claims 1 to 14 for the preparation of a vaccine intended for the prevention of malaria.

26. Use of one or more monoclonal or polyclonal antibodies according to Claim 18 for the preparation of a medicine intended for the treatment of malaria.